

## INFLUENCE OF SUGARBEET TILLAGE SYSTEMS ON RHIZOCTONIA-BACTERIAL ROOT ROT COMPLEX

**CARL STRAUSBAUGH AND IMAD EUJAYL**

USDA-ARS NWISRL, 3793 NORTH 3600 EAST, KIMBERLY, ID 83341

E-MAIL: CARL.STRAUSBAUGH@ARS.USDA.GOV

Rhizoctonia root rot on mature sugarbeet caused by *Rhizoctonia solani* is a widespread important disease problem, particularly in the Treasure Valley of Idaho. *Rhizoctonia* can lead to a dry black rot (Fig. 1) on about 5 to 10% of the root mass on the outer portion of the root with rot typically being initiated at the side of the root as opposed to the crown area. Although *R. solani* appears to initiate the rot process, other organisms frequently invade *R. solani* lesions. There is a strong tendency for a wet-type bacterial root rot (Fig. 2) to initiate in *R. solani* lesions by *Leuconostoc mesenteroides*, leading to a Rhizoctonia-bacterial root rot complex. While the fungal rot is typically associated with only a small percentage of the root mass, the bacterial phase can result in 70% or more of the root mass being rotted. The rot complex appears to increase in importance from south-central Idaho to south-western Idaho. Losses of 50% or more can occur in fields with the rot complex, but rotted roots can also lead to storage and factory processing losses.



**Figure 1. Dry black rot and deep cracking associated with Rhizoctonia root rot.**

With glyphosate-resistant sugarbeet cultivars becoming available in 2008, strip tillage is now being considered by growers in southern Idaho. With strip tillage only a small 20 to 30 cm wide band is disturbed with the tillage equipment and can be done in either the fall or spring. In Idaho, strip tillage has primarily been performed in barley or wheat stubble, but strip tillage following other crops is also being considered. The

standing stubble helps hold soil in place, especially in sandy soils susceptible to wind erosion, and helps protect young plants from wind damage. Protection from wind erosion and damage seem to be the primary benefits driving the interest in



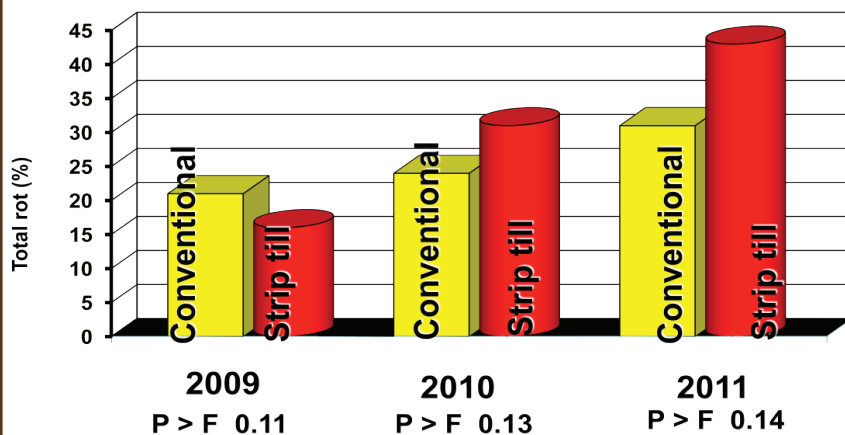
**Figure 2. Wet-discolored-rotted root tissue associated with the Rhizoctonia-bacterial root rot complex. Rhizoctonia typically initiates the rot process and leads to 5 to 10% of the root mass being rotted near the root surface, while subsequent bacterial invasion can frequently rot 70% or more of the root mass.**

Idaho, although other benefits such as better moisture retention, improved aeration, increased soil organic matter, optimal fertilizer placement, and reduced fuel costs are also important. Since high residue levels and increased moisture retention could influence root rot potential in sugarbeet production, the impact of this change should be evaluated. Consequently, studies were conducted over three years with the sugarbeet cultivar B-5 (consult Betaseed Inc. for actual name) to compare the influence of strip tillage versus conventional tillage on the Rhizoctonia-bacterial root rot complex in sugarbeet roots. The conventional tillage was fall plowed and roller harrowed twice in the spring, while the strip tillage was applied with a 2007 Strip Cat in the late fall into six inch barley stubble. The plants were inoculated at the 8-leaf growth stage with one of six *R. solani* AG-2-2 IIIB strains. A non-inoculated check was also included.

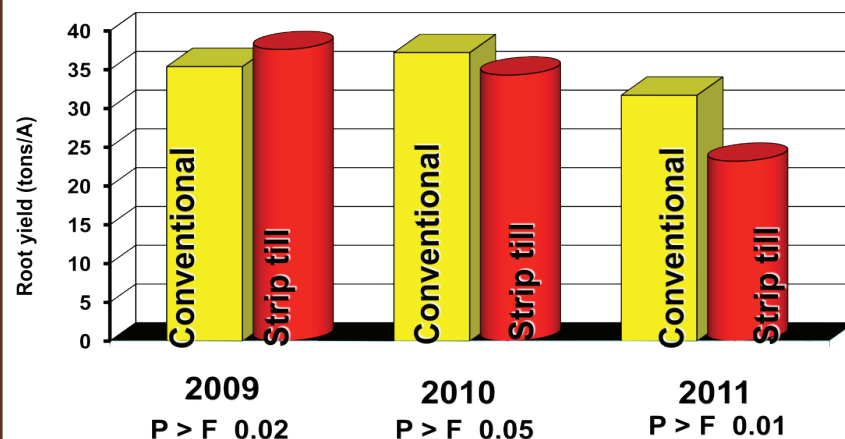
In general when comparing conventional and strip tillage, the *Rhizoctonia*-bacterial root rot complex responded in a similar manner for fungal rot (conventional 8% vs strip 7%), bacterial rot (26% vs 34%), total rot (33% vs 41%; Fig. 3), neighboring roots infected (1.7 roots vs 1.5 roots), distance spread (6.1 inches vs 5.9 inches), and number of dead plants (12% vs 14%). Based on these same disease variables, all six *R. solani* AG-2-2 IIIB strains were pathogenic when compared to the non-inoculated check. All six strains responded in a similar manner regardless of tillage, since there were no significant tillage by strain interactions ( $P > 0.10$ ). Although significant differences were evident at times between strains, the same ranking was not always evident over all three years. At the 10% statistical probability level, strip tillage resulted in more root yield in 2009 while conventional tillage resulted in more root yield in 2010 and 2011 (Fig. 4). For estimated recoverable sucrose, there were no differences in 2009 and 2010 between tillage treatments, but conventional tillage resulted in more recoverable sucrose in 2011. When comparing yield variables after the first two years, there appeared to be no

difference between tillage systems since conventional tillage averaged  $35.7 \pm 3.2$  t/A and strip tillage averaged  $35.2 \pm 3.2$  t/A. With the cool start to the growing season in 2011, plants in the strip tillage treatment clearly struggled compared to those in the open bare soil (likely absorbed more heat units from sun) in conventional tillage. Thus, there was a 26.8% root yield reduction ( $P = 0.012$ ) associated with strip tillage in 2011. When considering recoverable sucrose, the relationships were similar to those established with root yield.

Since the response of disease variables was similar between tillage systems, management of the *Rhizoctonia*-bacterial root rot complex with similar approaches should be possible. Traditional management approaches such as crop rotation with barley or wheat, in-furrow fungicide applications, and use of resistant cultivars (consult Cultivar Performance Guide) should be applicable to both tillage systems. Future research will need to identify better management options or optimize current options, since *Rhizoctonia* root rot is on the rise in Idaho and other production areas.



**Figure 3.** Total rot (fungal and bacterial rot combined) observed in plots under conventional and strip tillage in three studies from 2009 to 2011 in Kimberly, ID. Probability levels (shown below year) indicate significant differences between tillage systems could not be proven.



**Figure 4.** Root yield (tons/A) for plots under conventional and strip tillage in three studies from 2009 to 2011 in Kimberly, ID. Probability levels (shown below year) indicate significant differences between tillage systems were evident every year.